1. Telephone and Computer Cabling

In today's world of high speed information exchange, the pathway on which the information travels is crucial. Historically, the pathway for transmission of information has been cable. Cabling provides the pathway for exchange of information for telephone and computer systems. Copper cable is typically used for shorter distances, while fiber optic cable is typically used for longer distances. In addition, fiber optic cable is also used for shorter distances where extremely high speeds or extended capability, such as allowing multiple users to access the internet without loss of speed, is required.

Many years ago, it became apparent that the manufacturers of telephone and computer cabling were not producing their products to a similar standard. It was therefore difficult to assure that information exchange could effectively be accomplished over single, larger networks, or from one network to another. To remedy this problem, governing bodies were established to set standards for telephone and computer cabling. The governing bodies are called the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA).

Many documents that specify standards for generic telephone and computer cabling systems have been published by the EIA and TIA. The standards establish performance and technical criteria for various telephone and computer cabling system configurations for interfacing and connecting their respective elements. If complied with, these standards assure that the cabling systems will support a multi-product, multi-manufacturer environment. They also provide information that may be used for the design of cabling system products for commercial enterprises. Over the years, several standards have been written and adopted. And, as technology changes, new standards are continually being proposed, tested, and adopted by the governing bodies.

To aid in the quick identification of specific capabilities for cabling systems, the EIA and TIA have established a rating system. The rating is identified by a category number, with specific levels of performance specifications assigned to that number. In recent years, the performance of category 3 (cat 3) cable has generally been considered obsolete except for mass distribution of telephone signals. Category 5 (cat 5) cable, and enhanced category 5 (cat 5 e) cable, have most recently been considered the only acceptable standards for the distribution of computer signals.

Presently, a new standard of cable performance criteria has been proposed to the EIA and TIA called category 6 (cat 6). Category 6 cable will allow networks to operate at greater speeds and bandwidth. At this time, the cat 6 standard has not been adopted. However, it has been through numerous review committees, and it is generally assumed it will become the next standard for the distribution of computer signals. Based on this history, it is likely that prior to the actual construction of the capitol renovation project, a new standard will be proposed and possibly adopted by the EIA and TIA for distribution of computer signals

2. Voting Systems

Embedded in the central core values of our democracy, is the right of constituents to have full representation during legislative procedures. When issues of paramount importance, such as laws which govern our lives, are being voted upon, it is requisite that information regarding procedures and voting be available for our use. It is therefore obvious that the systems used to tally, record, and report the voting results of legislative bodies are of extreme importance. These systems must first and foremost be accurate. In addition, and among many other

things, they must also be reliable, and provide equal access in both the gathering and dissemination of information.

3. Audio and Video Systems

The state of Utah is nationally recognized as a leader in the implementation of technology based systems for electronic information sharing across the state. For example, due to the vision and leadership of our elected officials, as well as the technical expertise of numerous, dedicated engineers and technicians, the Utah Educational Network is a model of success for electronic classrooms. It is only fitting therefore that similar, state of the art technology for the capture, processing, distribution, and sharing of audio and video signals be installed in the building which represents our state.

On a national level, the advent of television broadcasting of all legislative body proceedings over CSPAN has been applauded as a national treasure of information useful in formal educational settings, as well as numerous activities of typical citizens. It follows, therefore, that it will not be far into the future when the same level of accessability to state legislative proceedings will be demanded by state constituents as well.

Due to the nature of the construction of both chambers, the chamber floor speakers are affixed to walls in a surface mounted fashion, while the gallery areas speakers are ceiling mounted. Each legislator's desk is equipped with a microphone, and all microphones are mixed and processed by electronic equipment located inside metal equipment racks. Controls for the audio systems are located inside both chambers. The audio equipment rack for the Senate is located in the corner of the Senate Chamber, and is directly accessed for control. The audio equipment for the House is located in an adjacent room, and is remotely controlled utilizing buttons and potentiometers located inside the House Chambers.

Presently, there are no video production systems installed at the Capitol.

The standards and criteria are developed to address the project goals of:

Life Safety

Function - Efficient / Effectiveness

Historic / Architectural Integrity

1. LIFE SAFETY

a. STANDARD: Reliable telephone and computer cabling systems for voice and data communications.

1) Objective: Cabling systems will fully comply with all EIA/TIA requirements relating to structured cabling systems.

2) Objective: Cabling systems will be well organized and completely identified.

2. FUNCTION - EFFICIENCY / EFFECTIVENESS

a. STANDARD: Digitally based, electronic systems.

1) Objective: Provide electronic system equipment which deploys the latest, proven, and reliable digital technology.

b. STANDARD: User friendly system operation.

1) Objective: Provide control systems which utilize commonly available human interface controls, with menu driven operating systems.

c. STANDARD: Fully capable cabling infrastructure.

1) Objective: Provide cabling system that will allow for a free exchange of information.

2) Objective: Provide cabling system that will not be a roadblock to access of information.

3. HISTORICAL / ARCHITECTURAL INTEGRITY

STANDARD: Mandate the extremely high quality installation of electronic systems, thereby preserving the historical and architectural integrity of the capitol.

1) Objective: Employ craftsmen who understand the magnitude of the capitol restoration, and who have demonstrated the ability to complete their work in full compliance with the highest standards of acknowledged industry practices, and all installation practices identified in the Uniform Building Code, and Sound System Engineering, (2nd Edition), D. Davis.

4. MINIMUM QUALITY LEVELS AND MANDATORY STANDARDS:

a. EIA/TIA 568 "Commercial Building Wiring Standard"

b. EIA/TIA TSB_36 "Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables", Category 5, and "Additional Transmission Performance Specifications for 4-Pair 100 Ohm Category 5e Cabling" as stated in Draft 11 of TIA SP4195.

c. Certified Level 5 Cable under UL's LAN Cable Certification Program

d. Certified type PCC FT4 FT6 for plenum cable.

e. IEEE 802.3

f. ICEA S80_576

g. UL Subject 444

h. National Electrical Code _ Article 800

i. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code."

j. EIA Compliance: Comply with the following Electronics Industries Association Standards:

1) Sound Systems, EIA_160.

2) Loudspeaker, Dynamic Magnetic Structures, and Impedance, EIA_299_A.

3) Racks, Panels, and Associated Equipment, EIA_310_A.

4) Amplifiers for Sound Equipment, SE_101_A

5) Speakers for Sound Equipment, SE_103.

6) Microphones for Sound Equipment, SE_105.

7) UL Compliance: Comply with requirements of UL 50.

1. Definitions

Prior to summarizing our survey of existing conditions for telephone and computer cabling, the reader may find a brief discussion of industry terminology to be useful. Some terms, such as copper, fiber, category, EIA, and TIA have been explained above. Other terminology which will be used later in this report is as follows:

a. *Structured cabling*: A system of well planned and organized cable installed into a building in full compliance with all EIA and TIA standards.

b. *Voice cable*: Cable which is used for distribution of telephone signals.

c. *Data cable*: Cable which is used for distribution of computer signals.

d. *Wiring closet*: A room inside of a building where multiple cables converge and are connected to system equipment.

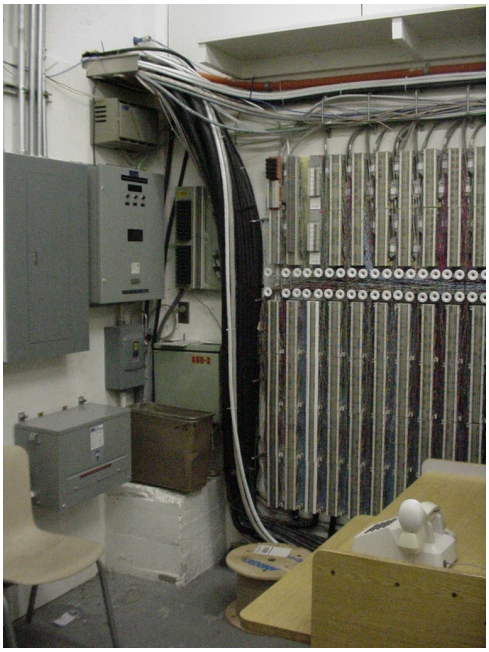
e. *Horizontal distribution*: Cable which is installed on a single level of a building, typically from a wiring closet to an office. This type of cable is also referred to as station cable.

f. *Vertical distribution*: Cable which is installed from wiring closet to wiring closet from floor to floor. This type of cable is also referred to as backbone cable.

g. *Termination*: A term used to describe the final connection of a cable.

h. *Patch panel*: A connection panel used for final connection of computer cable.

i. *Punch down block*: A connection panel used for final connection of telephone cable.


EXISTING WIRING CLOSET

2. Existing Voice/Data Cabling

The capitol building is presently equipped with a cabling system for telephone (voice) systems, and computer (data) systems. Horizontal, copper station cable is installed from office workstation/chambers desk outlets to intermediary wiring closets, and terminated using patch panels and punch down blocks. Vertical, fiber backbone cable is installed between wiring closets and into the main wiring closet on the basement level. The cabling systems presently installed range in age over the past several years.


OVERFLOWING CABLE TRAY

Consequently cable performance and termination methods vary depending upon the circumstances of the specific time. In general, we found that wiring closets and network electronics were scattered throughout the building. Primarily due to cable accessibility and limited options, we observed that the wiring closets are located where the building may allow rather than at sensible or desirable locations. For example, the wiring closet which serves the executive office is located in a stairwell. Although this location may temporarily serve the needs of the executive branch, it is in direct violation of many of the standards published by the EIA and TIA.

Presently, all cable pathways, such as cable trays and ladder runways, exceed their capacities. In many instances cable trays and ladder runways are filled in extreme excess of their capacity. At a vast majority of locations, cables are literally overflowing from cable trays, dangling over the edge of the cable pathway. The telephone and computer cabling systems as presently installed are in direct conflict with numerous EIA and TIA standards.


LED VOTING PANELS

3. Existing Voting Systems

Presently, voting systems are in place and operational inside the House and Senate chambers. These systems consist of an interface panel located at each desk in both chambers for gathering votes from representatives and senators. A majority of the human interface for the current voting systems are analog and mechanical in nature (push buttons). Votes are then tallied, recorded, and displayed on large LED panels. The LED panels have been installed over the historical finishes and thus have a significant negative impact on the room aesthetics. These panels are necessarily large so that they can be seen be multiple viewers in the gallery.

4. Existing Audio / Video Systems

The state capitol is presently equipped with audio systems only. Audio systems are located in the House and Senate Chambers. Over the years, the sound systems have been continually updated, and currently, the sound systems are in reasonable working order, and have been reported to adequately suit the needs of the legislative bodies.

Due to the nature of the construction of both chambers, the chamber floor speakers are affixed to walls in a surface mounted fashion, while the gallery areas speakers are ceiling mounted. Each legislator's desk is equipped with a microphone, and all microphones are mixed and processed by electronic equipment located inside metal equipment racks. Controls for the audio systems are located inside both chambers. The audio equipment rack for the Senate is located in the corner of the Senate Chamber, and is directly accessed for control. The audio equipment for the House is located in an adjacent room, and is remotely controlled utilizing buttons and potentiometers located inside the House Chambers.

Presently, there are no video production systems installed at the Capitol.

CEILING MOUNTED SPEAKERS IN GALLERY

SPEAKERS WALL MOUNTED ABOVE DOORS IN CHAMBERS

1. Telephone and Computer Cabling

Although existing capitol building cabling systems are functional in that they presently serve the majority of needs of most users, they are not "structured" or organized in an orderly manner. Due to the obvious fact that such systems did not exist when originally constructed, the capitol building interior does not easily lend itself to large scale distribution of sophisticated structured cabling systems.

This challenge is obviously not unique to Utah. During our research of recent capitol building renovations in other states, we learned that in Ohio, the architects, interior designers, and engineers were successful in the large scale implementation of a structured cabling system which is state of the art, and fully compliant with all EIA and TIA standards. A key element in achieving full compliance, was successful deployment of all wiring closets. In Ohio, all wiring closets are essentially stacked, meaning that the wiring closet on the second floor is directly above the wiring closet on the first floor, and so forth. This makes vertical distribution of the necessary backbone cabling very efficient and cost effective.

Another key element in the Ohio state capitol renovation was assuring that the maximum cable length standard specified by the EIA and TIA for horizontal station cable was not exceeded. This standard mandates that a wiring closet must be located no more than 300' from any data outlet. In addition to stacking the wiring closets, the architects, interior designers, and engineers were successful in carving out floor space for wiring closets on each floor at locations necessary to comply with this standard; all the while, maintaining the historical integrity of the original structure and floor plan. These accomplishments are admirable, and are no small task when one considers these two seemingly opposed end goals of faithful restoration of a very old building, and a complete update of all communication systems with state of the art equipment.

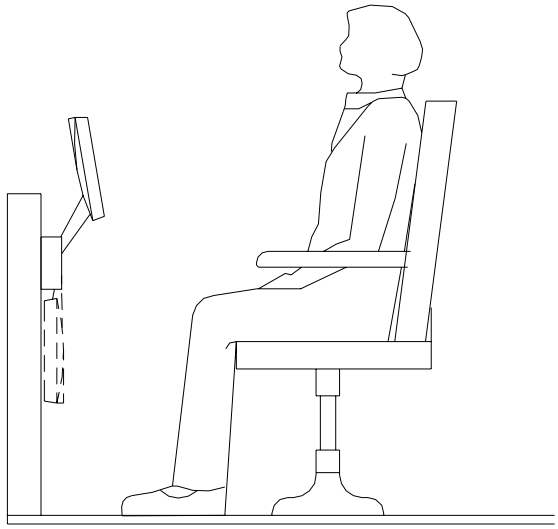
With the phenomena of electronic data exchange ever on the increase, in conjunction with the Governor's emphasis on technology systems in the state of Utah, it will be mandatory that all potential obstacles are overcome, and that high speed, wide bandwidth structured cabling systems be installed throughout the capitol in a carefully planned, and orderly manner. This will assure that data traffic will transfer at an extremely high rate, and that data traffic will not slow due to the volume of users. For example when multiple Senators are attempting to access the internet or data filed on the network the rate of information exchanged will not be reduced. It will be mandatory that all areas of the capitol have access to voice and data cabling. The cabling in each area will provide high speed access to all authorized local area networks, all authorized state wide area networks, and the internet; as well as all telephone system needs.

As in Ohio, extensive provisions for future expansion of the cabling system are also a vital consideration. Raceway systems for structured cabling are covered in the electrical section of this document. However, in general, raceway systems will provide for extreme future growth, and will deploy systems which simplify the implementation of future moves, adds, and changes.

2. Voting Systems

Regardless of the specific purpose of a voting system, today's technology dictates that state of the art equipment used for this purpose will be comprised of computers networked together, each loaded with a voting software package. From institutions of higher learning, to industrial training rooms, to legislative bodies, voting systems should utilize standard networked computers for information gathering, processing and display. Typical software packages of this type provide the means to cast votes, gather and tally votes, break down vote totals, and display vote results.

With this technology each Senator and Representative can view voting results on a computer moniotor located at their respective desk. A vote could be submitted by use of keyboard and mouse controls located at each desk. This approach significantly minimizes, or may eliminate, the need for large screens utilized for displaying information to large groups of people on the chamber floors.



These systems, however, do not satisfy the needs of constituents observing from the gallery. In the gallery area, it will also be necessary to display voting results. Historically, fewer large screen displays have been employed for this purpose. However, this approach generally imposes a significant negative impact on the rooms aesthetic environment, and deters the faithful renovation of all historical features in the room.

A successful trend currently being deployed for the dissemination of visual information in numerous similar governmental facilities uses multiple, small screen displays for viewing by one or two people. In many cases it has been determined that smaller monitors impact surrounding areas significantly less than large screen monitors, and in addition, provide a satisfying viewing experience for event participants.

A future trend which may be available at the time of renovation construction is wireless transmission to small handheld display screens. Similar to when one who is hearing impaired attends the theater, and checks out a wireless hearing assistive device, constituents could check out small display screens for use while observing legislative proceedings. Furthermore, technology such as infra-red transmission systems and Palm Piolets are already in place, and could, with minimal software adaptation be used for this purpose.

In addition, to local display of voting results, it is also desirable to make voting result available in real time to distant locations. This would provide a way for remotely located constituents to monitor proceedings in their governing legislative body. This can be accomplished by connecting the server which manages the voting network to the internet, and allowing access to voting results by the general public.

3. Audio and Video Systems

The audio systems required for use in the capitol will primarily be used for amplification of the human voice. Given this paramount system requirement, the audio systems should be specifically designed for optimal speech intelligibility in the frequency range produced by the human voice.

History has proven that successful implementation of a voice reinforcement public address system is a difficult challenge in spaces typical of the chamber areas. More often than not, speaker system locations are largely dictated by the building structure and architectural finishes, rather than allowing locations to be determined by standard engineering practices. Fortunately however, numerous new types speakers are available to today's designers which can be strategically placed to minimize the impact on room aesthetics. Nevertheless, all parties involved must come to the realization that ultimately speakers move air and generate sound waves; thus, the front of all speakers must be exposed to free air space in the rooms in which they are installed in order to propagate sound waves to listener ears. Consequently, regardless of the speaker locations selected, there will be some impact on the historical integrity of these rooms.

Sound systems used for legislative proceedings are typically equipped with system components tailored for specific uses. For example, microphones are selected for specific pick up patterns which are more effective at picking up a talker's voice in spite of possible poor microphone placement relative to the talker's mouth. Due to the large number of microphones used, microphone mixing systems are specified with "automatic" circuitry. This circuitry turns off microphones not being used, and changes volume levels when multiple microphones are in use, all without the aid of human intervention. Processors are provided which filter sound and compensate for the effect of the room environment on the sound system performance. And finally, speaker systems are carefully selected to cover all areas of a room with even sound pressure levels.

The video systems required for use in the capitol will vary depending upon the room in which they are used. The chamber video systems will be used for capturing the images of legislators during sessions. The systems will be comprised of permanently located, professional grade cameras located inside the chambers. These cameras will eliminate the need for news media cameras to be brought in during legislative sessions. Conversely, the committee rooms, and other large presentation rooms such as the Governor's board room, will be equipped with video systems for presenting information. Video and data projectors will be provided for large screen projection of video signals and computer signals such as Power Point presentations. In addition, media source devices such as video tape players, digital versatile disc players, and document cameras will be provided for use during presentations. In select rooms, such as the Governor's board room, video systems should also be equipped with all equipment required for video conferencing. This equipment will include cameras for image pick up, additional display screens for simultaneous viewing of multiple video images, microphone mixing systems equipped with integral echo cancellation for each microphone, and compression/decompression electronics (CODEC) to facilitate the use of standard phone lines as the transmission medium.

In addition to the above, the capitol will be equipped with full video production facilities. During our research of other recent state capitol renovations, we learned that video production

facilities have proven to be an integral part of the building's communication systems. In Ohio, for example, a fully equipped digital television production facility was installed, complete with a professional black box studio area, digital editing bay, and control room for live video production.

As it's name implies, the black box studio is a room which is painted flat black, and is fully equipped with the necessary infrastructure to be set up and used in many different configurations. It's purpose is to serve in many different roles as a flexible, controlled location for the production of audio and video programs. Many accessories are typically included in black box studios to facilitate standard, back drops for news conferences and interviews, as well as special back drops and lighting for community information announcements.

For example, a standard Utah State Capitol lectern, with appropriate flags and emblems would typically be used for news conferences. This would be accomplished utilizing a standard studio "set", and would typically remain assembled in one corner of the studio. Conversely, a portable blue screen background would be available for use in another portion of the studio. This backdrop would facilitate the use of chroma-key technology which allows any background to be interjected electronically behind a presenter, (like the whether man on the evening news).

All of the above systems will work together and provide facilities to capture, edit, record, produce, and distribute audio and video signals originating from legislative sessions, interviews, news conferences, public announcements, and other similar events all from within the walls of the capitol.

To achieve this, it will be requisite that at the heart of all audio and video systems, a central audio and video router be provided. The audio and video routing system will be the single point of convergence for all audio and video signals within the facility. From this point, it will be possible to receive a signal from any audio and video system in the building, and send it to various locations for processing, editing, viewing, and/or additional distribution. This central routing system should, if desired and authorized, also have direct fiber optic connections to the Utah Educational Network; and as in Ohio, connections to local television broadcasters.

The audio and video systems in all rooms will be coordinated such that the audio and video signals in the chamber areas, for example, will be captured and processed simultaneously. This is necessary so that when you see someone talking, you will also hear them at the same time. It will also be critical to provide audio and video tie lines to all rooms with audio and video systems in order to facilitate the distance communication requirements of the end users of these spaces. For example, a person in an office will be able to see and hear things originating in the chambers.

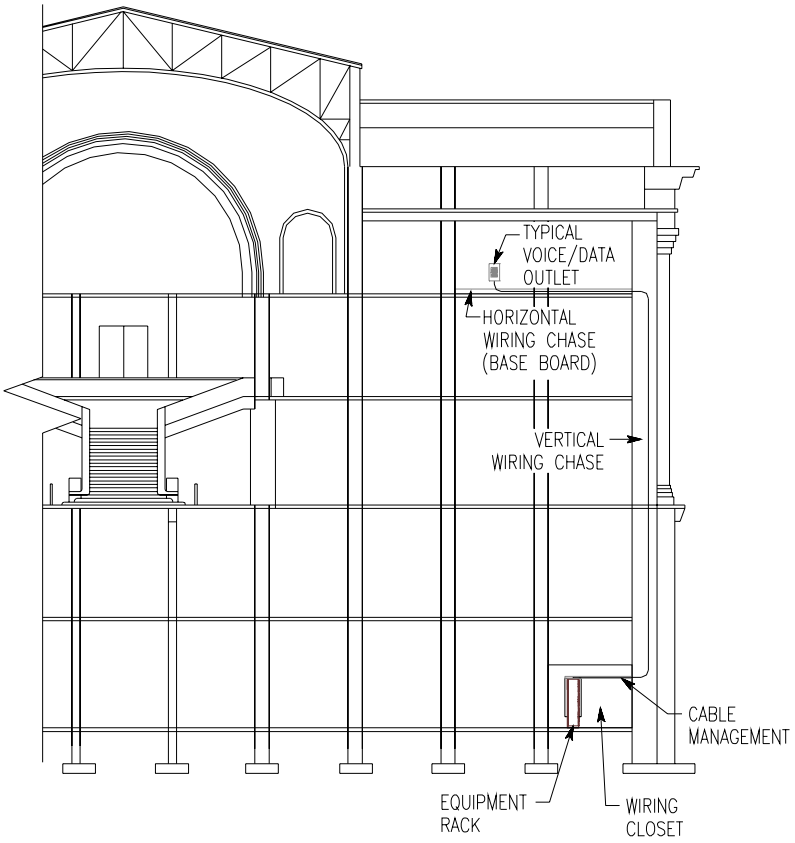
In addition to the standard base band audio and video systems discussed above, it will also be requisite to provide a TV signal distribution system. This system will be specified with the capability to receive and distribute local TV broadcaster signals and cable TV signals to all key capitol building locations. As with all other building audio and video systems, the TV distribution system will also be connected to the central audio and video routing system with appropriate modulation and de-modulation equipment. This will provide the capability of sharing signals between all audio and video systems within the building. This will provide a closed circuit cable TV system inside the capitol.

The reader may recognize that alternatives are somewhat limited relative to communication systems. For example, there is no alternative for television distribution systems. Either it is, or is not installed. The only question which remains, is what should the specifications of the TV distribution system be? Given the obvious fact that it is desirable for all communication systems installed as part of this renovation to last well into the distant future, all system infrastructures should be specified with the widest bandwidth and highest speeds available at the time of construction.

1. Telephone and Computer Cabling

a. The selected distribution method and positioning of wiring closets will be key in the successful implementation of a structured cabling system, while maintaining the historical integrity of the building. Alternatives available for locating wiring closets are as follows:

1) Vertical Stacking: As completed in Ohio, vertical stacking locates a portion of all wiring closets in the same position on each floor, such that vertical backbone cables can be installed through sleeves from floor to floor. This method is strongly recommended in the EIA and TIA standards as the preferred method for wiring closet distribution. Nevertheless, this method would require acquisition of square footage on every floor, including some areas which are identified as preservation zone 1.



2) Multiple, Horizontal Wiring Closet Locations: This method would locate a high density of wiring closets in the basement level and possibly the attic level, with a fiber optic backbone cable interconnecting all closets. (See image below as well as the following page) Station cable would then be installed from one of the wiring closets to a specific work area though multiple vertical chases at column lines around the perimeter of the building. This would require that station cable run both vertically and horizontally. The appropriate wiring closet would be selected based on the distance of the cable run. This method of wiring closet distribution is not recommended in the EIA and TIA standard; however, it does technically comply.

b.. The type of cable deployed for the structured cabling system will be of paramount importance relative to speed and bandwidth capability. Alternatives for system cabling are as follows:

1) Horizontal Cabling, Copper: Although at this time category 6 cable is a proposed standard only, it is likely that by the time of construction of this project, category 6 cable or higher will be an industry standard. The issue at hand is therefore not thecategory rating, but rather the concept of copper cabling. If copper cabling is selected as the distribution method for horizontal cabling, the cable used should be the highest rated copper available at the time of construction.

2) Horizontal Cabling, Fiber Optic: Fiber optic cable has many virtues which make it a candidate for horizontal cabling. First and foremost, the speed and bandwidth capability far exceeds that of copper cabling. It is therefore considered to be a future friendly signal distribution medium. In addition to the above, its distance limitations far exceed those of copper, and therefore, wiring closets can be located with less frequency. In fact, even though from a system administrator's perspective it may not be desirable, it would be conceivable to have a single, large wiring closet in the basement level. The significant disadvantage with fiber to the desk top today is that network electronics and computer network cards manufactured with fiber capability are significantly more expensive, and would require wholesale replacement of the majority of the existing state capitol network hardware. This, however, may not be the case at the time of the renovation construction.

3) Horizontal Cabling, Wireless Networks: At this time, wireless networks are in their infant stages. They work by locating transceiver/antenna devices throughout an area where a local area network is deployed. These transceivers then transmit and receive data signals to and from computers located in work areas which are equipped with a proprietary, wireless network interface card. Even though this portion of the signal distribution is wireless, each transceiver is connected to a wiring closet with conventional computer cabling. Presently, this technology is relatively slow when compared to wired networks. In addition, it is somewhat more costly, and more susceptible to eavesdropping. Nevertheless, this area of network electronics is one of the fastest growing areas, and it is obvious that significantly better and less costly alternatives will be available when construction on the capitol proceeds.

4) Backbone Cabling: Mandatory, multi-strand fiber cable will be required for the interconnection of all wiring closets.

5) Specialty Voice Cabling: In general, all computer and telephone signals will be distributed on the same type of cable. If fiber or wireless systems are selected for signal distribution, using computer networks for telephone service (voice over IP), or similar technologies should be used for the distribution of standard telecommunication signals. In addition, there will likely be a need for analog telephone service to specialty areas. The cable used for this purpose should be the highest rated copper cabling available at the time of construction.

c. Standardization of termination methods will facilitate the expanded use of structured cabling systems. In general, all cable used for computer or telephone signal distribution should be terminated utilizing patch panel technology. This method will not require network managers to acquire special tools or training, andwill be user friendly in facilitating future moves, adds, and changes. This is due to the fact that modifications to the structured cabling system can be made by simply using a short cord to re-route (patch) signals. Cable terminated in work areas will be connected to industry standard, modular connectors, and mounted on standard gang size wall plates.

d. Wire management systems will be provided within wiring closets to accommodate all present cable loads plus 100%. All wiring closet termination devices and wire management systems will be mounted to EIA/TIA standard, open frame equipment racks.

2. Voting Systems

a. Utilize fully networked personal computers located at each desk in both chambers for the voting system human interface. The computers will accept voting data from, and display voting results to all Senators and Congressmen. The voting network will be managed by a dedicated voting system server, which will also be connected to the internet for real time dissemination of voting results to the general public. This will allow the end users to cast votes utilizing their own computer keyboard and/or mouse, as well as see the voting results on their own computer screen.

b. The alternatives available for visual annunciation of voting results for constituents in the gallery area and committee rooms are as follows:

1) Deploy fewer, large screen displays for viewing by large groups of people. It is likely that these displays would be flat panel plasma monitors, and would be ceiling or wall mounted at higher elevations within the gallery areas. Plasma monitors are large screen video monitors.

VOTING BOARDS AS VIEWED FROM GALLERY

2) Deploy larger quantities of small screen displays for viewing by one or two people. It is likely that these displays would be flat panel LCD monitors, and would be wall or pedestal mounted at lower elevations withing the galley areas.

3) Consider further development of the necessary software and hardware interfaces to effectively allow hand held devices such as Palm Pilots or notebook computers to receive wireless transmissions of data streams which contain voting results.

4) Install telephone/computer cabling to all seats throughout the gallery area. This cable would provide a means for constituents to bring their personal notebook computers, log onto the internet, and view voting results in real time.

3. Audio and Video Systems

a. Audio systems will be provided in all large rooms where amplified public address capability is required. These rooms will include, but may not necessarily be limited to, the Senate and House chambers, the committee rooms, and the Governor's board room. The audio systems in the chambers will include:

1) Microphones with switches to turn them off, and indicator lights to tell the end user when they are turned off.

2) All sound system electronics required to pick up sound from a microphone and hear sound from a speaker.

3) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

4) Recording capabilities for making an audio record of proceedings.

5) Speakers selected for minimal impact on room architecture and for adequate sound pressure level coverage. Alternatives for speaker system types include:

a) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

b) Wall/ceiling mounted single point clusters of multiple speakers recess mounted into architectural features of the room.

c) Individual personal monitors built into the desks on the chambers floor.

b. The audio systems in the committee rooms will include:

1) Microphones with switches to turn them off, and indicator lights to tell the end user when they are turned off.

2) Wireless microphones for presenters.

3) All sound system electronics required to pick up sound from a microphone and hear sound from a speaker.

4) Manual mixing systems for media source audio such as video tape players, and digital versatile disk players.

5) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

6) Recording capabilities for making an audio record of proceedings.

7) Speakers selected for minimal impact on room architecture and for adequate sound pressure level coverage. Alternatives for speaker system types include:

a) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

b) Wall/ceiling mounted single point clusters of multiple speakers recess mounted into architectural features of the room.

c. The audio system in the Governor's board room will include:

1) Microphones with switches to turn them off, and indicator lights to tell the end user when they are turned off.

2) Wireless microphones for presenters.

3) Individual echo cancellation for each microphone to accommodate video and tele-conferencing.

4) All sound system electronics required to pick up sound from a microphone and hear sound from a speaker.

5) Manual mixing systems for media source audio such as video tape players, and digital versatile disk players.

6) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

7) Recording capabilities for making an audio record of proceedings.

8) Speakers selected for minimal impact on room architecture and for adequate sound pressure level coverage. Alternatives for speaker system types include:

a) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

b) Wall/ceiling mounted single point clusters of multiple speakers recess mounted into architectural features of the room.

d. A tonal system will also be provided outside the chamber areas, and inside rooms where Senators and Congressmen congregate. The system will make different sounds used to tell people that a session, or something similar, is about to start. System controls will be located within the individual chamber areas, and may be controlled manually or programed for automatic operation.

e. Professional grade tie lines will provide audio feeds from all sound systems to the audio and video central routing system so that all audio and video systems will be connected..

f. Video systems will be provided in the Senate and House chambers, the committee rooms, and the Governor's board room. The video systems in the chambers will include:

1) Professional grade, broadcast quality cameras with studio kit accessory packages. Alternatives for The central video production facilities will include a control room, black box studio, editing bay, and equipment room. The equipment in all rooms will be digitally based, and will include the following major equipment items:

a) Control room: Digital live video production switchers; multiple, professional grade video monitors; professional grade audio monitors; various types of signal processing, timing, and distribution equipment, studio production intercom system, and an intra-studio matrix router. All signal paths will flow through patch bays to and from their respective destinations. This will provide the end user with the capabilities of a television studio without the capability to broadcast signals.

b) Black box studio: Full scale infrastructure to facilitate various types of uses; multiple sets for various back drops; chroma key (blue screen) technology for electronically generated back drops.

c) Editing bays: Professional grade non-linear, digital editing equipment including PC based digital editors, video tape recorders, video monitors, and audio monitors. This will allow the end user to edit video tapes.

g. The capitol building will be served by a facility wide audio and video routing system. The routing system will be a large scale matrix switcher with remote control capability. The matrix switcher will be a single point of convergence for audio and video signals originating from, and traveling to, all audio and video systems throughout the building via professional grade audio and video tie lines. In addition, the matrix switcher will provide a gateway for interconnection to the Utah Educational Network, and authorized connections to local television broadcasters.

h. A TV signal distribution system will be provided for the dissemination of TV signals from local, satellite, and cable broadcasters. Appropriate modulation and demodulation equipment and tie lines will also be provided to the facility wide audio and video routing system.camera controls are:

1) Cameras equipped for manned operation.

2) Cameras equipped with pan, tilt, and zoom accessories for remotely controlled operation.

i. The video systems in the committee rooms will include:

1) Large screen projection systems including video/data projectors, projection screens, and motorized mounting devices to conceal projection systems when not in use.

2) Multiple input panels at key locations for input of computer grade and video grade signals.

3) Media source devices for origination of various types of video signals during presentations. Alternatives for media source devices include:

4) Video tape players, for playback of video tapes.

5) Digital versatile disc players, for playback of DVD's.

6) Document cameras to show a picture of a transparency or something similar (similar to a standard overhead projector, but equipped with a camera instead of an optical lens, see image below).

7) Slide to video convertor to show a picture of a slide (a slide projector with a camera inside for capturing the image of the slide, see image below).

8) Computers

9) Integrated control systems for control of all room audio, video, and lighting functions. Control panel alternatives for human interface include:

10) Wireless touch panel - this will allow the control panel to be moved to different locations within the room.

11) Wired touch panel - this will provide a single location for control panel.

j. The video systems in the Governor's board room will include:

1) Large screen projection systems including video/data projectors, projection screens, and motorized mounting devices to conceal projection systems when not in use.

2) Supplementary display screens for simultaneous viewing of images during video conferencing.

3) Cameras on pan, tilt, and zoom drivers for use during video conferencing.

4) Compression and decompression equipment (CODEC) for transmission and reception of video conference signals over standard telephone lines.

5) Multiple input panels at key locations for input of computer grade and video grade signals.

6) Media source devices for origination of various types of video signals during presentations. Alternatives for media source devices include:

a) Video tape players

b) Digital versatile disc players

c) Document cameras (similar to a standard overhead projector, but equipped with a camera instead of an optical lens, see image above).

d) Slide to video convertor (a slide projector with a camera inside for capturing the image of the slide, see image above).

e) Computers

7) Integrated control systems for control of all room audio, video, and lighting functions. Control panel alternatives for human interface include:

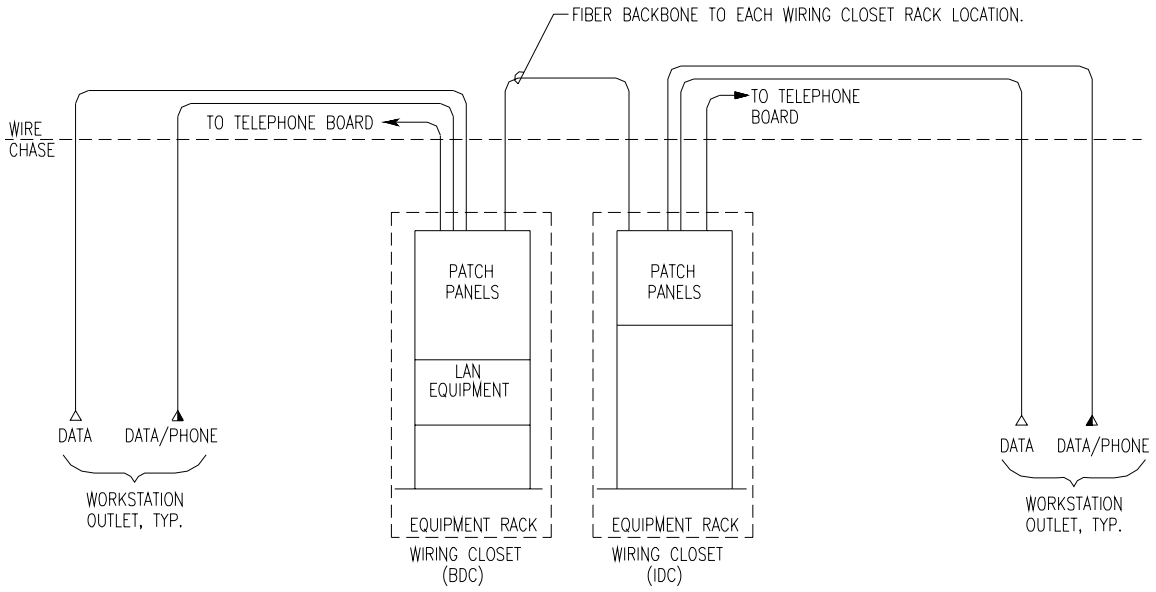
a) Wireless touch panel

b) Wired touch panel

1. Telephone and Computer Cabling

a. Wiring Closets: Generally, it would be our recommendation to locate wiring closets in full, literal compliance with the EIA and TIA standards, in much the same way that the Ohio state capitol was renovated. However, in this case, due to our research to date, and the mandate that preservation zone 1 areas will not be alteredfrom their original state, we recommend that multiple, horizontal wiring closet locations be used in the basement and possibly supplemented in the attic.

b. Horizontal Cabling: If required to make a decision today, we would recommend



VOICE/DATA DISTRIBUTION DIAGRAM

that copper horizontal cabling be deployed on this project. However, due to the nature of this industry, where computers and network hardware are obsolete immediately after purchase, we would recommend that an in-depth analysis be completed relative to this portion of the system just prior to building construction.

c. Backbone Cabling: Mandatory, multi-strand fiber cable will be required for the interconnection of all wiring closets.

d. Specialty Voice Cabling: The highest rated copper cabling available at the time of

construction will be required for specialty voice applications.

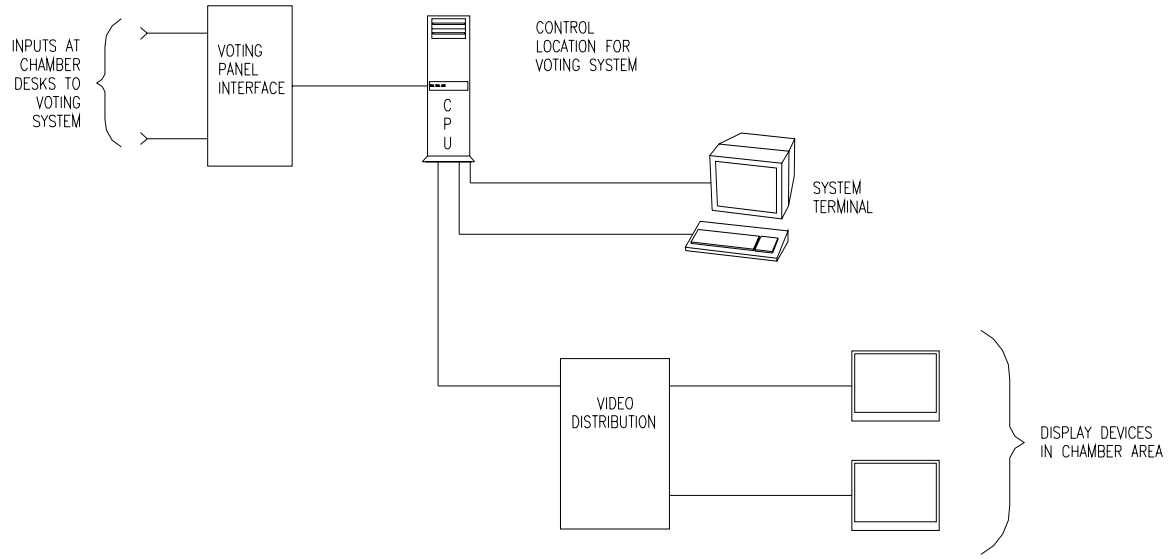
e. Termination Methods: We recommend identical termination methods for all telephone and computer cabling utilizing patch panel technology. We further recommend that cable terminated in work areas be connected to industry standard, modular connectors, and mounted on standard gang size wall plates.

f. Wire Management Systems: We recommend that wire management equipment be provided within wiring closets to accommodate all present cable loads plus 100%. All wiring closet termination devices and wire management systems will be mounted to EIA/TIA standard, open frame equipment racks.

2. Voting Systems

a. We recommend the utilization of fully networked personal computers located at each desk in both chambers for the voting system human interface. Network management of the voting system will be accomplished utilizing a voting system server with a dedicated internet connection.

b. Unlike display screens that are used for entertainment value, or for continual transfer of information during a presentation, these display screens will be used much like a



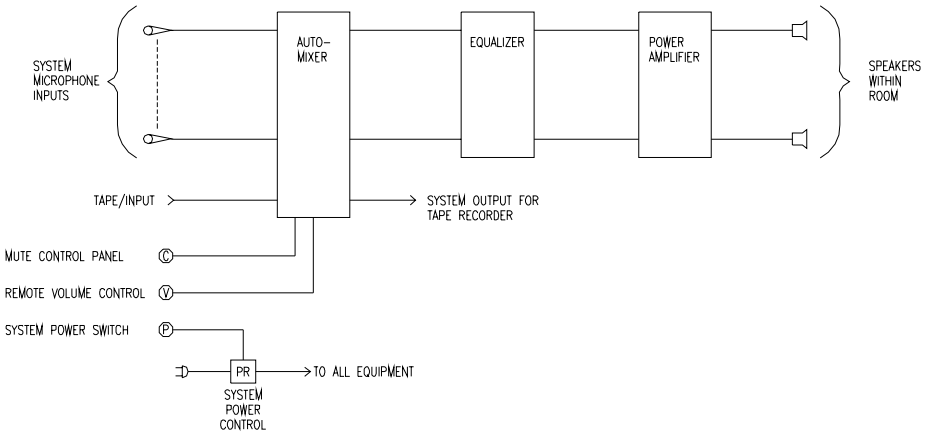
VOTING SYSTEM

score board at a sporting event. For this type of use, the information on the display screen is very important to events that are occurring on the floor, but the display screen does not need to be continually viewed, simultaneously with the events occurring on the floor. The information on these display screens can be viewed more infrequently, after the culmination of an event. It is therefore our opinion that the necessary display screens do not have to be located for simultaneous viewing of visual information along with the events occurring on the floor; and thus, can be carefully located with room aesthetics considered a primary factor in determining room placement. Given this opinion, we recommend that visual information be disseminated to constituents in the gallery area utilizing large screen displays at relatively few, key locations for viewing by large groups of people.. We believe that these displays can be wall or ceiling mounted in a way which does not significantly distract from the room aesthetics, and will provide equal access to voting information for people from all walks of life, regardless of their technical savvy.

3. Audio and Video Systems

a. We recommend that audio systems provided in the chambers include the following:

1) Microphones with local mute switches and indicator lights for visual annunciation of microphone status.



CHAMBER/COMMITTEE ROOM SOUND SYSTEM

2) Automatic microphone mixing systems, digital processors, and power amplifiers.

3) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

4) Recording capabilities for making an audio record of proceedings.

5) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

b. We recommend that audio systems provided in the committee rooms include the following:

1) Microphones with local mute switches and indicator lights for visual annunciation of microphone status.

2) Wireless microphones for presenters.

3) Automatic microphone mixing systems, digital processors, and power amplifiers.

4) Manual mixing systems for media source audio such as video tape players, and digital versatile disk players.

5) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

6) Recording capabilities for making an audio record of proceedings.

7) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

c. We recommend that the audio system provided in the Governor's board room include the following:

1) Microphones with local mute switches and indicator lights for visual annunciation of microphone status.

2) Wireless microphones for presenters.

3) Individual echo cancellation for each microphone to accommodate video and tele-conferencing.

4) Automatic microphone mixing systems, digital processors, and power amplifiers.

5) Manual mixing systems for media source audio such as video tape players, and digital versatile disk players.

6) Electronic equipment will be installed outside of the room in a nearby area, and will be remotely controlled.

7) Recording capabilities for making an audio record of proceedings.

8) Ceiling mounted distributed speakers recess mounted into architectural features of the room.

d. We recommend that an audio tone signaling system be provided outside the chamber areas, and inside rooms where Senators and Congressmen congregate for audible indication of upcoming votes and/or the commencement of sessions.

e. We recommend that professional grade tie lines be provided for audio feeds from all sound systems to the audio and video central routing system.

f. We recommend that video systems provided in the chambers include the following:

1) Professional grade, broadcast quality cameras with studio kit accessory packages.

2) Cameras will be equipped for manned operation.

g. We recommend that video systems provided in the committee rooms include the following:

1) Large screen projection systems including video/data projectors, projection screens, and motorized mounting devices to conceal projection systems when not in use.

2) Multiple input panels at key locations for input of computer grade and video grade signals.

3) Media source devices for origination of various types of video signals during presentations. Alternatives for media source devices include:

a)Video tape players

b)Digital versatile disc players

c)Document cameras

d)Slide to video convertor

e)Computers

4) Integrated control systems for control of all room audio, video, and lighting functions, with a wireless touch panel.

h. We recommend that video systems provided in the Governor's board room include the following:

1)Large screen projection systems including video/data projectors, projection screens, and motorized mounting devices to conceal projection systems when not in use.

2)Supplementary display screens for simultaneous viewing of images during video conferencing.

3)Cameras on pan, tilt, and zoom drivers for use during video conferencing.

4)Compression and decompression equipment (CODEC) for transmission and reception of video conference signals over standard telephone lines.

5)Multiple input panels at key locations for input of computer grade and video grade signals.

6)Media source devices for origination of various types of video signals during presentations. Alternatives for media source devices include:

a)Video tape players

b)Digital versatile disc players

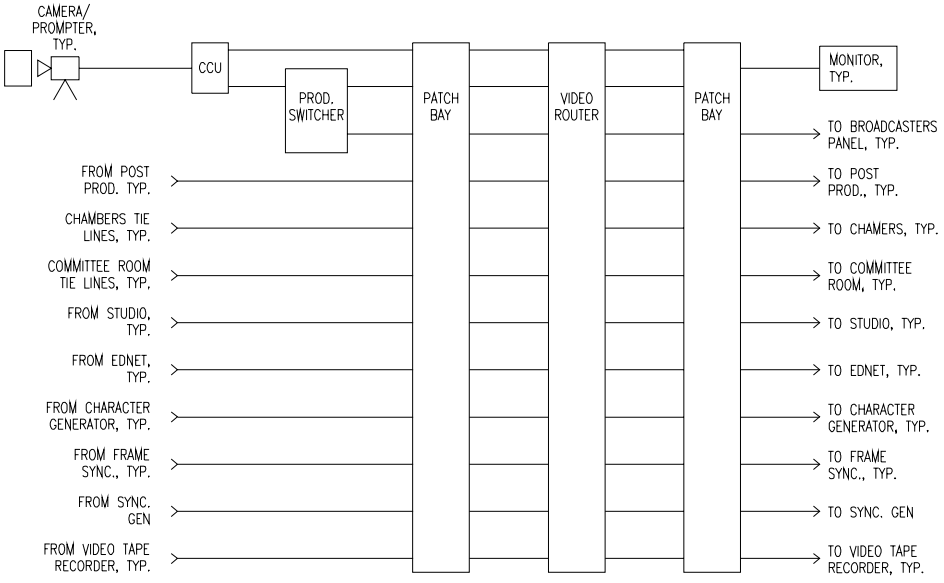
c)Document cameras

d)Slide to video convertor

e)Computers

7)Integrated control systems for control of all room audio, video, and lighting functions with a wireless touch panel.

i. We recommend that professional grade, central video production video facilities be provided and include a control room, black box studio, editing bay, and equipment room. The equipment in all rooms will be digitally based.j.



VIDEO SYSTEM BLOCK DIAGRAM

j. We recommend that a central, facility wide, audio and video matrix switcher be provided to act as a single point of convergence for all audio and video signals originating from within the capitol, as well as a connecting point to the Utah Educational Network, and authorized connections to local television broadcasters.

k. We recommend that a TV signal distribution system will be provided for the dissemination of TV signals from local, satellite, and cable broadcasters; with connections to the facility wide audio and video routing system.